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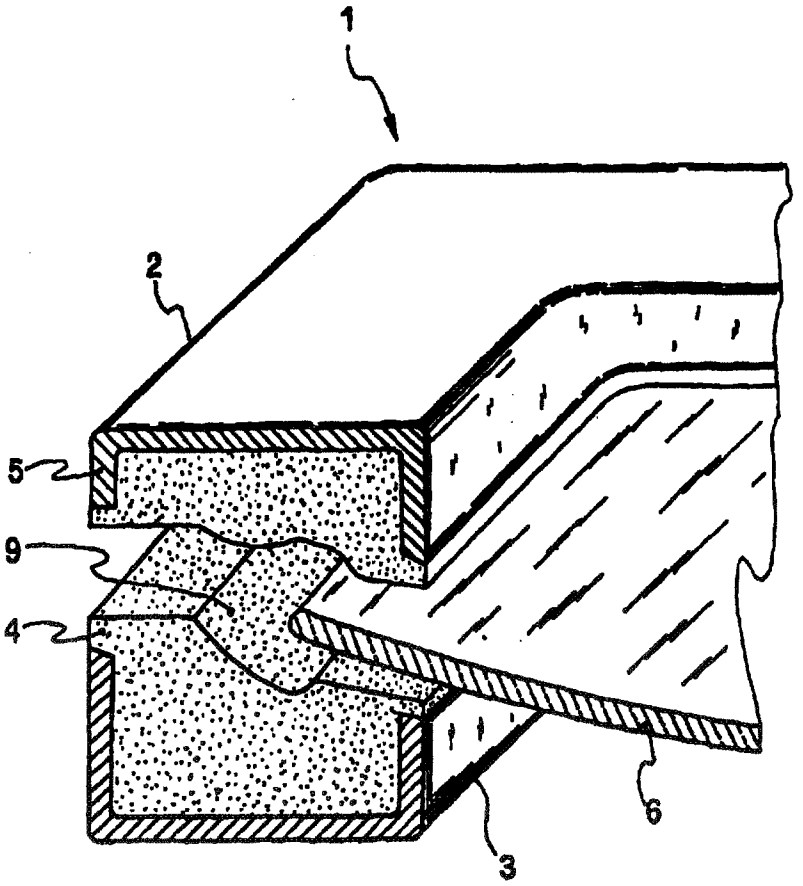
(54) Title: PROCESS AND DEVICE FOR ENVELOPING THE EDGES OF A GLASS PANE WITH A POLYURETHANE GASKET

(57) Abstract

A process for the manufacture of a glazing module comprising a pane (6) of glazing material and gaskets able to be used in automotive glazing applications in order to fill, under low pressure, a specially built mold, with a polyurethane composition having a slow reaction speed. The mold (4) is made of plastic material and has a ring type configuration, around the peripheral area of the pane (6) corresponding to the gasket's application position. The new process allows the manufacture of new window and gasket assembly at lower costs than those performed with known techniques.



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Process and device for enveloping the edges of a glass pane with a polyurethane gasket.

DESCRIPTION

Technical Field

The present invention relates to a process for the manufacture of a glazing module comprising a pane of glazing material to be used in automotive applications, and a gasket adhering to its peripheral area.

The present invention also relates to a device that carries out such process.

Industrial Applicability

The automotive glazing market requests glazing material already equipped with the gasket, so that the assembler, for example the car manufacturer, is only obliged to glue such glazing material onto the automobile structure. By so doing the glazings assembly costs are reduced.

Background Art

Different processes developed for the manufacture of window and gasket assembly are known by the state of the art.

The Italian patent n. 1.178.437 of Libbey Owens Ford Company (L.O.F.) describes a process for the manufacture of a window and gasket assembly that uses a polyurethane composition injected into a metal mold, method known by the state of the art with the initials RIM (Reaction Injection Moulding), and which has been widely spread in the industry.

The main advantage of this method lies in the speed with which the mold is filled and in the composition's high reaction speed so a finished piece is obtained in less than a minute and a half.

Nevertheless, such process presents some drawbacks: the high injection speed induces, in the filling phase, high pressure values, so the mold itself must be made of metal by consequence at high costs; the mold must be

equipped with a temperature control device because its must be kept within a certain rate in order to optimize the reaction time; the gasket has residual flash due to the flowability of the material and to the high pressure; furthermore the bent pane interlayered often presents a change in shape that is not absorbed by the mold causing it to break; it is then necessary to apply to the mold an antistiking agent in order to easily extract the finished piece, without ripping the gasket.

In synthesis such process, even if quick, proves to be very expensive for the type of mold it requires, for the very close tolerances to be respected by the pane to be encapsulated and for the fact that the application of an antistiking agent and an additional operation of residual flash removal is needed.

Another process for the manufacture of glass gasket assembly known by the state of the art is that of the European patent n. 121481 belonging to S. Gobain which describes a method for the application of a gasket on glass by an extrusion process and subsequent hardening of a polymer directly on the peripheral surface of the glass. The assembly is then sealed on the car's bodywork. The main drawbacks in this case are: the beginning and the end of the extruded gasket must be joined by a connecting operation which is carried out separately; if such connection is visible from the outside and is not hidden inside the bodywork of the car, the operation requires a long time and expensive methods. Furthermore the extrusion cannot supply a gasket that extends much beyond the outer edge of the glass; in this case in fact it is necessary to use one or more "supporting molds" that determine the increase of the production costs. An additional drawback of such process consists in the fact that gaskets presenting section changes along the perimeter of the glass cannot be produced.

Disclosure of the Invention

The scope of the present invention is to eliminate

the above mentioned drawbacks. The invention, characterized by the claims, solves the problem of manufacturing a glazing module that does not show the typical flashes of the RIM process of the LOF patent and that at the same time does not need a connecting operation, in addition to the extrusion one, as does the S. Gobain patent, thus achieving the favourable effect of manufacturing a glazing module at low costs and however much lower than those of the state of the art.

This scope is reached through the improvement of the RIM method known by the state of the art.

For the present description the definition of glazing material applies to safety glass such as tempered glass, laminated glass, double glazed glass, covered or uncovered with antilacerating film or with sun-proof thin layers and all glasses that conform to the ECE 43 standards for automotive use, and applies also to plastic transparent material such as, for example, polycarbonate.

The process object of the present invention provides the molding of a gasket on an automotive glazing material by filling a mold, made of plastic material, with a polyurethane composition, at a slow speed, selected so as to show an appropriate gel time. The filling speed is selected in such a way that the filling time of the entire mold is less than the gel time of the composition; the pressure in the mold must be slow enough in order not to deform the plastic material walls that make up the mold's cavity.

Such improvement provides a much slower process, when compared to the RIM process patented by LOF, but consents to obtain pieces without flash and less breakage of the pane.

In fact the molds, according to an additional favourable characteristics of the process object of the present invention, are built with plastic materials chosen among those that are self-sealing on its own surface and on the pane and antistiking with respect to

polyurethane elastomers.

Therefore they are built with a silicone elastomer and/or fluoride silicone elastomer or with polyurethane fluoride elastomer or as a stratification of such fluoride silicone on a silicone elastomer base. The walls of the cavity to be filled, in a different realization, can show a thin antistiking metal insert supported by the elastomer body of the mold.

The above mentioned elastomers can be used as they are or charged, for example with glass microspheres, in order to increase compactness and hardness, to prevent shrinkage and also to decrease the required amount of elastomer, thus further reducing the manufacturing costs of the mold.

The mold, made up of two half-molds that when joined together generate the cavity showing the final section and position of the gasket, it is realized by copying from a reproducing pattern using the simple and well-known technique that casts the material on the pattern and waits for it to harden. In case there is the presence of metal insert, this is applied on the reproducing pattern and subsequently on the mentioned metal insert the casting of the elastomer takes place.

The use of molds made of plastic materials easily compensate the dimensional variations of the pane to be processed, thus reducing breakage; furthermore, thanks to the characteristics of the self-sealing materials on the pane and thanks to the fact that the work is carried out under low pressure, a processed piece is obtained without flashes in correspondence to the closing area of the two half-molds.

After having removed the glazing module from the mold the only operation in fact that is carried out is the removal of the two feed-heads, one on the entrance to the composition and the other on air discharge.

In the process object of the present invention the low pressure definition is referred to the maximum pressure

values required for filling the mold lower than 3 kg/cm^2 and the definition of gel time is referred to values which are equal or above 30 seconds.

It is referred that the " introducing or filling pressure" is the rate of the counter-pressure generated by the sliding resistance in the mold and read by means of a gauge located on the entrance flow.

The gel time is defined as: the time that takes the polyurethane composition at a 25 °C to reach a viscosity that will not cast freely.

The filling takes place with a composition made up of a prepolymer belonging to the family of reaction products between aromatic and/or aliphatics isocyanates modified in such a way that the same must result liquid at a temperature between 25°C and 35°C and polyols (polyether and/or polyester and/or polycaprolactones).

In order to obtain a polyurethane elastomer, such prepolymers are then reacted with an adequate amount of chain extender chosen between the aromatics and/or aliphatics amines and/ or short chain polyols, with an NCO index that ranges from 1,00 to 1,10,.

The components of the mixture are chosen so that the reaction speed gives a gel time, measured at a 25°C, equal or above 30 seconds. Before the filling operation, a degassing operation of the composition is preferably carried out.

The mold has an entrance hole, where the composition is poured, and an exit hole where air discharge is possible. Depending on the condition of the process and on the size of the pane, additional adequately arranged entrance/exit holes are forecasted.

Since the mold's filling pressure is very low and however not above 3 Kg cm^2, it is preferred that the air discharge hole have a diameter at least equal to the composition's entrance hole in order to help as much as possible flowing of the poured liquid inside the mold's cavities.

Such condition makes the mold's filling operation similar to the one defined as " open sky" in order to indicate the composition's injection pressure rates which are substantially close to the 1kg/ cm^2 rate.

An object of the present invention is a process for the realization of a glazing module comprising a pane of glazing material to be used in automotive applications and a polyurethane gasket adhering to its peripheral area, where such gasket is produced by polymerization of a mixture comprising a) a prepolymer composition made up by the reaction product of isocyanate and polyols and b) a chain extender and that fills a mold directly applied on the pane,characterized by the introduction operation of said mixture into said mold in the presence of an outlet for the pressure created in the mold by the introduction of the same mixture and with a mold filling speed chosen so that the total filling time of the mold be less than the gel time of the same mixture, and characterized by the fact of using the heat contribution developed by the polyurethane exothermic polymerization reaction in order to establish the temperature inside the mold and by the fact of utilizing as mold one mold made up by a self-sealing elastomer on its own surface or on the pane and antisticking with respect to the polyurethane, obtained said mold by means of a molding operation on a reproduction model of such gasket.

An additional object of this invention is a mold for the realization of a glazing module comprising a pane of glazing material to be used in automotive applications and polyurethane gasket adhering to its peripheral area, where such gasket is produced by a polymerization of a mixture comprising a) a prepolymer composition made up by the reaction product of isocyanates and polyols and b) a chain extender, said mold having an internal cavity and entrance and exit holes for the introduction of said mixture to be polymerized, characterized by the fact that it is made up of a elastomeric plastic material chosen

from the class that includes the silicone elastomers, fluoridated silicones or fluoridated polyurethane or by a combination of these, having self-sealing characteristics on themselves or on the pane and antisticking with respect to polyurethane and by the fact that the inside mold's temperature is established by using the heat contribution developed by the exothermic polymerization reaction of said mixture.

Vantageously the mold used to activate the process according to the invention shows a ring configuration that surrounds the peripheral area of the pane to be molded, leaving therefore visible most part of surface of the pane itself, conferring this way to the shaping device the features of lightness, manageability and quicker interchangeability.

The advantages obtained with the present invention, when compared to the RIM process known by the state of the art, consist in the reduction of the mold's manufacturing costs, in the reduction of the composition's feeding system costs, in the reduction of the costs due to the lack of accessory operations (mold release application, flash removal), since the molds are heated by exothermic reaction there are no heating costs, increase in the total production yield as a consequence of less pane being broken and utilization flexibility. In fact, in this last case, thanks to the lightness of the molds, it is possible to build a large number of molds, prepared to produce different models, assembled on a carousel, fed by a single dosing machine, reaching thus a utilization flexibility which cannot be obtained with other known processes, as for example with the RIM method or with the extrusion method.

Brief Description of Drawings

Additional advantages and characteristics of the invention will be cleared as a result of the following description, given merely as a non limiting example and referred to in the attached drawings in which:

- figure 1 represents a longitudinal sectional view of the mold realized according to the following invention;

- figure 2 represents a perspective view of the mold according to the invention.

Best Mode for Carrying out the Invention

According to the present invention a polyurethane composition is introduced at a pressure not higher than 3Kg/cm ^{2} in the cavity of a mold built according to the references in figures 1 and 2.

A mold 1 is built in two parts: a half-mold 2 and a half-mold 3 placed on opposite sides and complementary with respect to the pane 6 where gasket 7 is applied on its periphery.

The half-molds 2 and 3 are made of plastic material 4, self-sealing on its own surface and on the pane 6; silicone elastomer or polyurethane fluoride or a combination of these is used as plastic material 4; such material 4 is contained in a light metal structure 5, preferably aluminium, with the scope of giving the necessary rigidity to the manipulations.

When the half-molds 2 and 3 close on themselves and on pane 6, by means of handling equipment not shown in the drawing, a cavity 9 is formed having the shape and the position of the final gasket. A casting hole 8 crosses the metal structure 5 and the material 4 in order to allow the introduction of the polyurethane composition on cavity 9. Such composition is distributed by a dosing machine not shown in the drawing.

One or more holes for air discharge, not shown in the drawing, are appropriately dislocated on the half-molds; the diameter and the number of air discharge holes depends on the circulation difficulty of the composition in the mold.

The air discharge hole diameter is preferably equal to or larger than the entrance hole diameter so as to approach as close as possible the "open sky" conditions.

The two half-molds 2 and 3 have no additional devices in order to guarantee the seal drafting of the composition from cavity 9 for the following reasons: the casting pressure in the mold is very low (not higher than 3 Kg/cm^2); the material 4 is self-sealing, therefore upon closing the two parts, sufficient seal is guaranteed so as to avoid flash formation.

In order to build the half-molds 2 and 3 the plastic material in a liquid state is casted on a reproducible model that shows the copy of the gasket to be obtained; such plastic material reticulates on such shape and generates the desired mold. The internal part of the mold's cavity can if necessary be covered with a metal layer to increase the life of the mold itself. The layer will be vantageously thin enough so that the elastic characteristics of the mould's material will not be altered.

Furthermore the general configuration of the mold can be preferably built having the shape of a ring which surrounds the peripheral area of the pane without occupying the central part of the same pane. This allows the application of the gasket on the pane in the desired position with equipment having a reduced overall dimension and weight, so as to render the mold's accessory handling equipment simpler and less expensive.

For the sake of merely giving a non -limiting example follows a preferred shape for the realization of a half-mould 2 in silicone elastomer.

The half-mold 2 reproducible model is closed on container 5; the necessary amount of silicone elastomer, preferably mixed with a variable percentage of glass microsphers that goes from 2 to 4%, is casted in an hole opportunely made in the container and the air is discharged from the outlets. After the necessary drying time (24 hours with 40 -50% humidity) the half-mold is extracted and ready to be utilized.

Figure 2 represents a preferred realization of a mold used in the present process consisting of a ring-shape that surrounds the periphery of pane 6. Mold 1 made up of the half-molds 2 and 3 leaves uncovered most part of pane surface 6, giving the entire device manageability and lightness features.

The polyurethane composition is introduced in the mold with a maximum pressure below 3 Kg/cm² in the cavity of mold 9, made up by the half-mold 2 and 3 closed on pane 6 and on themselves.

An example of a polyurethane composition suitable to be used in the process according to the present invention is given as a non-limiting example.

EXAMPLE 1

A pure diisocyanate type MDI (diphenylmethane-diisocyanate) having 33,6% of NCO, is reacted with a polyether with OH numbers equal to 56.

Utilizing 55 g of weight for the isocyanate and 45 g for the polyols polyether having an OH equal to 56 a prepolymer is prepared containing 16,5% ± 0,3 of free NCO.

Later 100 g of the above mentioned prepolymers are mixed with 138 g of a mixture made up of 127 g of polyols having a molecular weight of 2000, 11 g of butandiol, 1,0 of an UV absorber, 0,8 of an amino catalyst and 2,2 g of a pigment realizing an NCO index of about 1,05. A degassing operation of the above described mixture is preferably carried out immediately before filling in the mold.

The mixture has a gel time of a minute and thirty seconds. Said composition, is introduced, at a temperature of 35°C, with a maximum pressure lower than 2,4 Kg/cm², into mold 1, realized as previously mentioned, and left without any thermostatic control.

The introduction pressure of the composition into mold 1 is measured as the value of the back pressure generated by the flowing pressure resistance into the

same mold and measured by a gauge located on the entrance flow.

The extraction time of the pane gasket assembly from the mold, made up with such composition, is equal to 15 minutes.

The gasket does not show flashes and undergoes only a rapid removal operation of the casting feed-heads.

The tests for UV resistance, humidity and high temperatures and the mechanical tests anticipated in the specifications have given positive results.

In particular, 24 hours after the extraction, a hardness value was found at an environmental temperature of 70 Shore A.

CLAIMS

1. A process for the realization of a glazing module comprising a pane of glazing material to be used in automotive applications and a polyurethane gasket adhering to its peripheral area, where such gasket is produced by polymerization of a mixture comprising a) a prepolymer composition made up by the reaction product of isocyanate and polyols and b) a chain extender and that fills a mold directly applied on the pane,
characterized by the introduction operation of said mixture into said mold in the presence of an outlet for the pressure created in the mold by the introduction of the same mixture and with a mold filling speed chosen so that the total filling time of the mold be less than the gel time of the same mixture, and characterized by the fact of using the heat contribution developed by the polyurethane exothermic polymerization reaction in order to establish the temperature inside the mold and by the fact of utilizing as mold one mold made up by a self-sealing elastomer on its own surface or on the pane and antisticking with respect to the polyurethane, obtained said mold by means of a molding operation on a reproduction model of such gasket.

2. A process according to claim 1, where said heat contribution developed by the polyurethane exothermic polymerization reaction is exclusively utilized in order to establish the temperature inside the mold.

3. A process according to claim 1 or 2, where said isocyanates are aromatic or aliphatic isocyanates both liquid at a temperature between 23 and 35°C.

4. A process according to any of the claims from 1 to 3, where said mixture has a gel time which is not less 30 seconds at a 25°C temperature.

5. A process according to any of the claims from 1 to 4, where the introduction pressure measured in the mold is not greater then 3 Kg/cm^2.

6. A process according to any of the previous

claims, where the temperature of said mixture introduced in the mold is not less than 25°C.

7. A process according to any of the previous claims, where the introduction of said mixture is preceded by a degassing operation therefore the polymerization of the same mixture produces a polyurethane material which is a compact elastomer.

8. A process according to any of the preceding claims, where said glazing material is tempered glass or laminated glass or double-glazing glass or a combination of these.

9. A process according to claim 8, where the glass is covered by antilacerating films or by thin layers of sun-reflective coating.

10. A process according to any of the claims from 1 to 7 , where said glazing material is plastics transparent material.

11. Mold for the realization of a glazing module comprising a pane of glazing material to be used in automotive applications and polyurethane gasket adhering to its peripheral area, where such gasket is produced by a polymerization of a mixture comprising a) a prepolymer composition made up by the reaction product of isocyanates and polyols and b) a chain extender, said mold having an internal cavity and entrance and exit holes for the introduction of said mixture to be polymerized, characterized by the fact that it is made up of a elastomeric plastic material chosen from the class that includes the silicone elastomers, fluoridated silicones or fluoridated polyurethane or by a combination of these, having self-sealing characteristics on themselves or on the pane and antisticking with respect to polyurethane and by the fact that the inside mold's temperature is established by using the heat contribution developed by the exothermic polymerization reaction of said mixture.

12. Mold according to claim 11 characterized by

the fact that the inside mold's temperature is established only by using the heat contribution developed by the exothermic polymerization reaction of said mixture

13. Mold according to claim 11 or 12 where said glazing material is a tempered glass or laminated glass or double-glazing glass or a combination of these.

14. Mold according to claim 11 or 12 where said glazing material is plastics transparent material.

15. Mold according to claim 11, where said elastomer plastic material includes filling materials able to increase compactness, hardness and deformability under charge.

16. Mold according to claim 15, where said charging material is made up of glass microspheres.

17. Mold according to any of claims from 11 to 16, where the wall of said internal cavity of the mold is covered by a metal layer in order to increase the life of the mold, said layer being thin enough as not to alter the elastic characteristics of the mold's material.

18. Mold according to any of the claims from 11 to 17, where at least one of said air exit holes has a diameter which is not smaller than the diameter of the entrance hole for said mixture, in order to obtain a discharge of the pressure created in the mold by the introduction of said mixture and to avoid an unwanted pressure increase.

19. Mold according to any of the preceding claims, obtained by casting and curing the plastic material onto a reproducing model.

20. Mold according to any of the claims from 11 to 19, made up by the combination of two separate pieces.

21. Mold according to any of the claims from 11 to 20, showing a general ring-shaped configuration that is arranged only in correspondence to the pane periphery so as to surround the same pane for the application of the desired gasket.

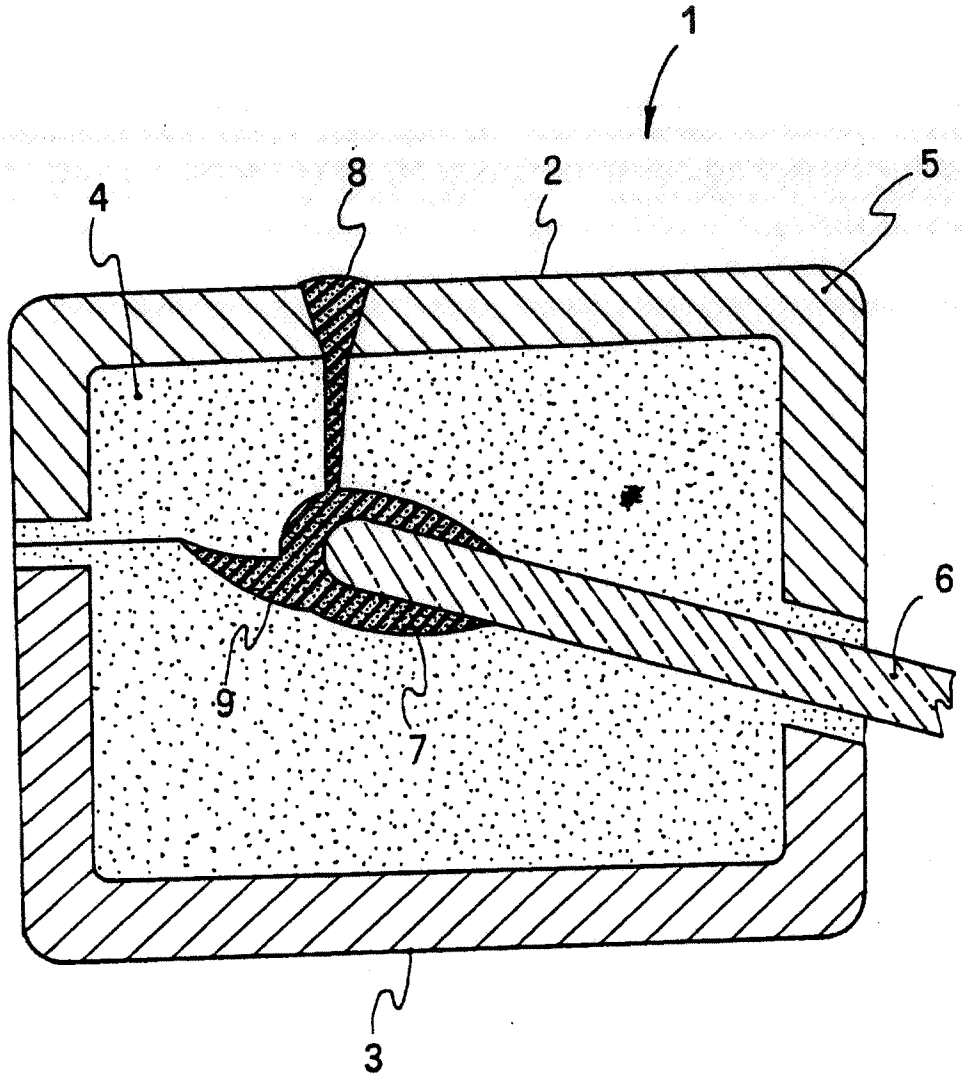

FIG 1

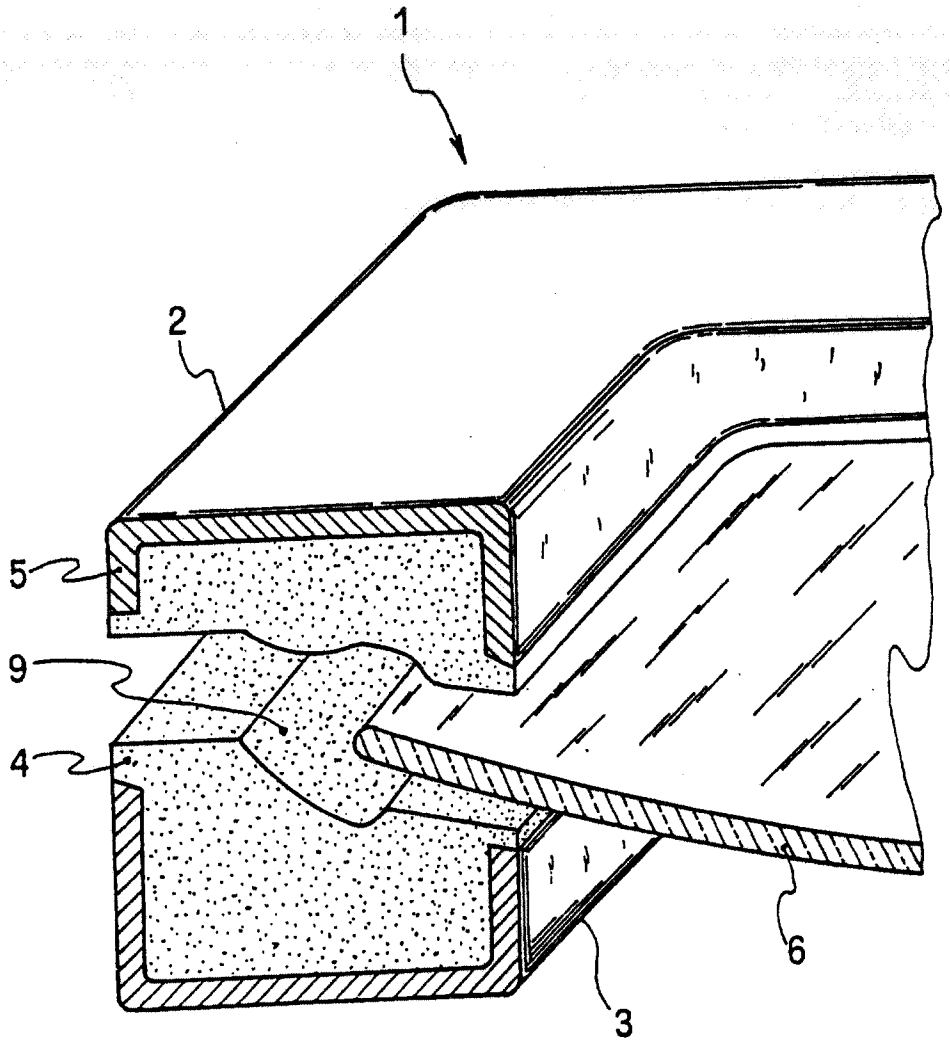

FIG 2

INTERNATIONAL SEARCH REPORT

International Appl. on No
PCT/IT 95/00186

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 B29C70/76 B29K75/00 B29L31/26

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 B29C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US,A,5 268 183 (L.A.A.M. GARZA) 7 December 1993 see column 3, line 9 - line 17 see column 5, line 48 - line 60; figures 1,2 see column 6, line 40 - line 50; figure 1 see column 10, line 39 - line 48; figure 5 see column 12, line 46 - line 61 see column 13, line 4 - line 8 ---	1-21
X	EP,A,0 375 485 (SAINT-GOBAIN VITRAGE INTERNATIONAL) 27 June 1990 see column 5, line 50 - line 55; figure 1 see column 7, line 6 - line 50 see claims 1,11 --- -/--	1,5,11, 18

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
25 March 1996	18. 04. 96

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax (+31-70) 340-3016	Topalidis, A

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US,A,4 999 147 (H. KOJIMA ET AL.) 12 March 1991 see column 6, line 64 - column 8, line 58; claim 1; figures 1,2	1,5,11, 13
A	EP,A,0 436 438 (AUTOMOBILES PEUGEOT ET AUTOMOBILES CITROEN) 10 July 1991 see page 2, line 29 - line 50 see page 4, line 38 - page 5, line 1; claims 1,4; figures see page 7, line 18 - line 21	1,11
A	US,A,4 839 122 (W.R. WEAVER) 13 June 1989 see column 3, line 40 - line 68; claim 1; example	1,11
A	EP,A,0 173 907 (BASF AG) 12 March 1986 see page 15, line 1 - line 4; claim 1; examples	1,6,11

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International App. on No
PCT/IT 95/00186

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		US-A-	5413748	09-05-95
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		DE-T-	3782979	07-10-93
		EP-A,B	0252207	13-01-88
EP-A-436438	10-07-91	FR-A-	2657308	26-07-91
		DE-D-	69003520	28-10-93
		DE-T-	69003520	14-04-94
		ES-T-	2044501	01-01-94
		JP-A-	4288207	13-10-92
		US-A-	5464575	07-11-95
US-A-4839122	13-06-89	AU-B-	580563	19-01-89
		AU-B-	3349684	04-04-85
		BE-A-	900661	16-01-85
		CA-A-	1259090	05-09-89
		CA-A-	1237860	14-06-88
		DE-A-	3435365	11-04-85
		DE-D-	3485324	16-01-92
		EP-A,B	0156882	09-10-85
		FR-A-	2553083	12-04-85
		GB-A,B	2147244	09-05-85
		JP-A-	60104412	08-06-85
		JP-T-	60502250	26-12-85
		LU-A-	85554	02-04-85
		NL-A-	8402900	16-04-85
		WO-A-	8501468	11-04-85
		US-A-	4561625	31-12-85
EP-A-173907	12-03-86	DE-A-	3432205	13-03-86
		CA-A-	1255067	06-06-89